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Crypto Survives in Some Pools

Chlorine levels recommended for swimming pools and water parks may not be high enough to kill a parasite that causes diarrhea, according to ARS experts in the parasite *Cryptosporidium parvum*. This single-celled organism is transmitted in the feces of infected people and animals. Infection occurs by ingesting oocysts. Because the oocysts are small and resistant to chlorine, standard filtering and chlorination may not be effective. *Cryptosporidium* has caused numerous recent outbreaks in recreational water, such as swimming pools and water parks, often visited by diapered children.

In collaboration with the Centers for Disease Control and Prevention (CDC), ARS researchers tested water that had fecal matter added to simulate conditions in a contaminated swimming pool. When the water contained this organic matter, currently recommended levels of chlorine did not kill the parasite, the researchers reported in *Emerging Infectious Diseases*, 1999, (vol. 5). That's because organic material deactivates some of the chlorine. Swimming pools are likely to contain hair, skin cells, suntan lotion, algae or leaves, and sometimes urine and feces—all of which can decrease the effectiveness of chlorine. Previous tests showing that recommended chlorine levels are adequate had been conducted in clean water.

Based on the ARS findings, the CDC suggests changes in engineering of public pools and water parks, such as improved filtering and more frequent turnover of the water. It also suggests changes in pool policies, such as requiring diapered children to wear rubber pants or "swim diapers." And it recommends educating staff and visitors about the following simple measures for preventing waterborne disease transmission:

- Stay out of the pool while ill with diarrhea and for several days afterward
- Try not to swallow pool water
- Use safe diaper changing and hand washing practices
- Give young children frequent bathroom breaks
- Encourage swimmers to shower before entering a pool.

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Fruits and Vegetables Build Strong Bones, Too

To guard against osteoporosis, people may be wise to eat more fruits and vegetables as well as dairy products. Recent research finds a significant association between intakes of potassium, magnesium and fruits and vegetables—which are good sources of the minerals—and a measure of bone strength in elderly men and women.

Researchers at the ARS/Tufts center in Boston and at Harvard Medical School analyzed data from 907 members of the original Framingham Heart Study—345 men and 562 women. They were looking for correlations between the elders' intakes of each mineral and of fruits and vegetables in general with bone mineral density measurements at the hip and wrist. They found correlations across the board—with potassium alone, magnesium alone, potassium and magnesium together and fruits and vegetables together. Men and women with high intakes had stronger bones, the researchers reported in the *American Journal of Clinical Nutrition*, 1999, (vol. 69, pp. 727-736).

Bone is living tissue. Its density is constantly affected by diet and exercise. Fruits and vegetables may help prevent the loss of bone minerals by counteracting the acid environment generated during normal digestion. When the body's environment is acidic, minerals are believed to be drawn out of the bone to neutralize the acid, thereby reducing bone strength. It is also possible that potassium and magnesium have direct effects on bone cells, the researchers conjecture.

They also analyzed data from a smaller group—229 men and 399 women—looking for changes in bone mineral density over time. In measurements four years apart, they found a slowing of bone loss in men—but not women—linked to potassium and magnesium levels, separately and together, as well as fruits and vegetables.

Fruits and vegetables provide one-third of the potassium in the U.S. diet and a little more than one-fifth of the magnesium. Good sources of potassium include bananas, oranges, tomatoes, potatoes, broccoli and melon. Good sources of magnesium include a variety of whole foods including fruits and vegetables, milk, fish and whole grains.

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Just Cutting Fat Doesn't Lower Cholesterol

If you go on a low-fat diet, you will surely lower your cholesterol count, right? Not necessarily, according to an ARS study. Among 11 healthy men aged 20 to 35 who volunteered for the study, cholesterol levels didn't change significantly—regardless of whether the men were on a low-fat or high-fat regimen. Fat calories made up 39 percent of the day's total calories in the high-fat menus, while accounting for only 22 percent during the low-fat regimen—a cut of nearly half.

Why didn't such a drastic drop in fat intake lead to a similar decrease in cholesterol? The researchers contend that it was because they didn't change the ratio of fats—that is, saturated to polyunsaturated to monounsaturated. The fat profile in both diets was 28 percent saturated fat—the kind in butter or lard; 33 percent monounsaturated fat; 6 percent monounsaturated trans fats, as are found in some margarine; and 29 percent polyunsaturated fats–the kind in healthful cooking oils. Other minor fatty acids made up the remaining 4 percent. The findings are reported in *Lipids*, 1995 (vol. 30, pp. 969-976).

All volunteers ate the high-fat diet for 20 days. Then, six volunteers ate low-fat meals for 50 days, while the other five volunteers ate the high-fat foods: whole milk instead of nonfat, and cream cheese rather than jelly on their breakfast bagels, for example. After that, the two groups crossed over to the opposite menus for the final 50 days of the study.

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Women's Depression Not Linked to Iron-Poor Blood

Is depression in women of childbearing age linked to low iron reserves? No, according to a recent study that found no relationship between mood and marginal iron status. That's different from severe iron deficiency, which can cause depression.

About one in five women of childbearing age has low iron stores, compared to one in 60 men. Twice as many women as men are clinically depressed—a gender difference that begins in adolescence. Depression is more pronounced among married women ages 25 to 45 with children. But earlier studies on the subject produced conflicting findings. So a nutritionist and a psychologist checked 384 women, ages 20 to 45, who were not diagnosed as depressed.

Unlike some earlier studies, they used a standardized psychological profile and mood checklist to test the volunteers. They also analyzed the volunteers' blood samples by the most sensitive tests of iron stores. They found no relationships between mood scores and three signs of iron status—serum ferritin, serum iron and hemoglobin, the researchers reported in *Behavioral Medicine*, 1999, (vol. 25, pp. 62-68). Serum ferritin is the first indicator of iron status to drop, while hemoglobin is the last and most resistant indicator to change. Iron deficiency severe enough to cause depression and fatigue would show up in a simple hemoglobin or hematocrit test, the researchers say.

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Osteoporosis Gene Linked to Calcium Absorption

A variation in the gene that enables vitamin D to attach to cells predicts differences in dietary calcium absorption and bone density in healthy children, researchers recently found. Other studies have shown that the variation, called the ff genotype, is associated with lower bone mass in adults and children. The variation is in the Fok1 site of the vitamin D receptor gene. The new finding, showing that people with certain genotypes absorb calcium less efficiently, is a step toward understanding why some groups appear more likely to develop osteoporosis, the researchers say.

They studied the relationship between the three genetic variations of Fok1, known as FF, Ff and ff, and markers of calcium status in 72 healthy children between 7 and 12 years of age. The children were tested for calcium absorption, bone mineralization and bone density.

Those with the FF genotype absorbed over 40 percent more calcium from their diet than those with the ff genotype and 17 percent more than those with the Ff genotype. The FF genotype children also had significantly greater bone density measurements, the researchers report in the *Journal of Bone Mineral Research*, 1999 (vol. 14, pp. 740-746). Peak bone mass occurs in early adulthood and is considered an important determinant of osteoporosis risk later in life.

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Iron for Premature Infants—Is Formula the Best Way?

Extra iron is part of physicians' nutritional strategies for newborn premature infants. But they disagree on whether their tiny patients should get the iron along with their formula or between feedings. A new study concludes iron-fortified formulas are a good option.

While the researchers found that premature infants had a very small increase in iron that was given separately, it is not significant compared to the extra effort required and the possible stomach irritation that can come with a separate supplement. It is simpler and effective to use iron-enriched formulas for premature infants when breast feeding isn't an option. The findings are reported in *Pediatric Research*, 1998 (vol. 44, pp. 507-511).

Pediatric nutritionists have long agreed that extra iron can also push up red blood cell production. As a result, many milk formulas designed for preemies are fortified with iron. But the researchers wanted to know if the high levels of calcium in preemie infant formulas interfere with iron absorption. They traced red blood cell iron use in 13 premature infants given both kinds of iron treatments. They used stable isotopes of iron to compare the rate that the infants' bodies used the iron in formulas versus separate supplements.

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Mining Health Treasures from Soybeans

ARS and University of Illinois scientists are combing through leftovers from soybean oil and protein extraction, searching for components that might help people stay cancer free. The idea is to add DNA-friendly compounds--or chemoprotectants—to foods and pharmaceuticals. Some natural and synthetic chemicals cause DNA breakage that can result in malignancies, but chemoprotectants help prevent irreversible cell damage.

The soy leftovers consist of a gooey molasses that has been used as livestock feed. A light brown powder called phytochemical concentrate (PCC), isolated from the molasses, contains a mixture of these potent materials. About 30 percent of the PCC powder are isoflavones—some of which are already known to inhibit cancer. In fact, specific isoflavones are already being marketed as food additives. Saponins—foaming agents often found in detergents—make up another 30 percent of the PCC powder, while the remaining 40 percent is a mix of sugars and other substances. ARS researchers are separating PCC into different fractions for biological assays at the University of Illinois.

In one assay, they look for changes in DNA damage to individual hamster ovary and lung cells. The saponins, they report in *Teratogenesis, Carcinogenesis and Mutagenesis*, 1999 (vol. 19, pp. 121-135), are proving to be quite effective at preventing DNA damage by a known carcinogen—even more so than the isoflavones. A mixture of soy saponins, all derivatives of soyasapogenol b, completely prevented DNA damage by the carcinogen, which was a compound commonly found in charred meat at relatively low levels.

In another assay, they look for changes in growth of human colon tumor cells. So far, they have tested only the isoflavone fractions and found genestein most effective at suppressing cell growth. Chemoprotectants isolated from these leftovers could become, pound for pound, more valuable than the main processed soy products, the researchers say. They note, however, that at high doses some of these protectants can have the opposite effect—actually increasing DNA damage. So care must be taken in gathering all the data needed to prevent public exposure to harmful levels in foods or pharmaceuticals. This research, supported in part by the United Soybean Board, may serve as a model for research on other foods.

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Database of Phytonutrients in Soy Foods

A new USDA database on the World Wide Web will help scientists pinpoint which of the estrogen-like compounds in soy foods may be responsible for a lower risk of cancer, especially breast cancer. Some of these compounds, known as isoflavones, have also been reported to benefit the cardiovascular system or to reduce bone loss after menopause. The new database is on the web at: **http://www.nal.usda.gov/fnic/foodcomp/Data/isoflav/isoflav.html.**

ARS scientists compiled the database, which gives values for the major isoflavones in 128 soy foods and ingredients. Isoflavones, such as daidzein, genistein and glycitein mimic the hormone estrogen. They also have antioxidant capability and may perform other functions that enhance health.

The researchers evaluated and compiled some 30 scientific reports of the isoflavone content of foods. And they

relied heavily on analyses by a collaborator at Iowa State University in Ames. Commercial products were analyzed to arrive at isoflavone values for some types of foods or food additives. The database gives isoflavone values for some individual brand names.

The database springs from a larger effort by the researchers to compile information on health-enhancing phytonutrients in foods. It follows on the heels of a database of carotenoids—such as beta and alpha carotene, lycopene and lutein—in 215 foods launched last fall. Future plans include a database for food flavonoids, such as catechins in tea, naringin and taxifolin in citrus, and quercitin in onions, apples and red wine.

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Double Whammy for E. coli *and* Salmonella

Treating alfalfa seeds and sprouts with a combination of irradiation and chlorine effectively safeguards them against *E. coli O157:H7* and *Salmonella,* researchers found. Not only did the dual treatment kill both organisms, it extended the shelf life of sprouts from about five days to more than a week. This is good news for sprout growers. Since 1995, raw alfalfa sprouts have been recognized as a source of foodborne illness in the United States, with several outbreaks of both *E. coli O157:H7* and *Salmonella*. Since sprouts can't withstand abrasive physical washing because of their fragility, cleaning the seed has become the primary focus.

Along with irradiation, the researchers subjected alfalfa seeds to three concentrations of calcium hypochlorite—a chlorine source. A 3-percent weight-per-volume concentration equals about 20,000 parts per million of available chlorine. When the pH is neutral, the 2.5- and 3-percent concentrations reduced *E. coli* by 99.99 percent. The pH level is important because when the solution is more alkaline, such as pH 10, the chlorine would change to a form that would be less effective against bacteria.

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According to the scientists, the best way to eliminate pathogens would be a combination of irradiation and sanitation treatments. That's because sprouts and seeds may be contaminated internally, which would prevent a surface disinfectant from working effectively. In the tests, the scientists used the irradiation dose approved for meat. The U.S. Food and Drug Administration has approved ionizing radiation as a safe and effective food preservation tool. The research is part of an effort by a task force of representatives from several federal agencies and industry to find ways to control microbial contamination of sprouts .

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For Real: A Tomato with Vine-Ripened Taste

Changing the levels of a key hormone in tomatoes could lead to fruit that tastes better and lasts longer. Such a tomato could be on the market in about three years, the scientists estimate. The scientists genetically altered the levels of auxin, a hormone that causes a tomato to grow and ripen. It's also known as the youth hormone because it keeps plants in a more youthful state.

Scientists have been studying auxin for more than 120 years. They've been able to change auxin levels, but the changes were expressed throughout the plant, not just in the fruit. The aim is to control the hormone production so that it can be introduced into specific targeted tissues—such as the fruit— without affecting the growth processes in other parts of the plant.

The researchers inserted a backward copy of a corn gene—iaglu—into a tomato. In its normal sequence, the iaglu gene reduces free auxin levels. The reversed gene, however, counteracts the tomato iaglu gene, thereby increasing auxin levels. This slows the ripening process and keeps tomatoes "youthful" longer. Because the gene was put in with a fruit-specific promoter, only the tomato fruit was affected.

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